

BERHAMPUR UNIVERSITY  
BHANJA BIHAR, BERHAMPUR-760007 (ORISSA)

**COURSES OF STUDIES FOR  
MASTER IN COMPUTER APPLICATIONS**

(Applicable for Students taking admission from 2011)

**Objectives of the MCA Course**

The MCA curriculum has been designed keeping in view the requirements of the IT industry and also to serve as a foundation for higher studies in computer science. It focuses both on theoretical and practical aspects of computer science. After successful completion of this course a student can join the IT industry as a system professional or pursue research in the core areas of computer science and applications.

<b><u>First Semester</u></b>	<b><u>Midterm &amp; End Sem</u></b>
CS 1.1 Computer Programming	20+80 marks
CS 1.2 Data and File Structures	20+80 marks
CS 1.3 Logical Organization of Computers	20+80 marks
CS 1.4 Mathematical Foundations of Computer Science	20+80 marks
CS 1.5 Technical Communication	20+80 marks
CS 1.6 Practical - 1 (C Programming & UNIX/LINUX )	100 marks

<b><u>Second Semester</u></b>	<b><u>Midterm &amp; End Sem</u></b>
CS 2.1 Data Base Management Systems	20+80 marks
CS 2.2 Operating Systems	20+80 marks
CS 2.3 Computer Architecture	20+80 marks
CS 2.4 Computer Oriented Numerical & Statistical Techniques	20+80 marks
CS 2.5 Management Information Systems	20+80 marks
CS 2.6 Practical - 2 (Data Base)	100 marks

<b><u>Third Semester</u></b>	<b><u>Midterm &amp; End Sem</u></b>
CS 3.1 Object Oriented Programming with C++	20+80 marks
CS 3.2 Algorithm Analysis and Design	20+80 marks
CS 3.3 Computer Network	20+80 marks
CS 3.4 Computer Based Optimization Techniques	20+80 marks
CS 3.5 Software Engineering	20+80 marks
CS 3.6 Practical – 3 (C++ Programming)	100 marks

<b>Fourth Semester</b>	<b>Midterm &amp; End Sem</b>
CS 4.1 Programming in Java	20+80 marks
CS 4.2 Object Oriented Modeling	20+80 marks
CS 4.3 Information Security	20+80 marks
CS 4.4 Distributed Systems	20+80 marks
CS 4.5 Computer Graphics	20+80 marks
CS 4.6 Practical – 4 (Java Programming)	100 marks

<b>Fifth Semester</b>	<b>Midterm &amp; End Sem</b>
CS 5.1 E-Commerce	20+80 marks
CS 5.2 Artificial Intelligence	20+80 marks
CS 5.3 Data Mining	20+80 marks
CS 5.4 Elective-I	20+80 marks
CS 5.5 Elective-II	20+80 marks
CS 5.6 Minor Project & Comprehensive Viva	100 marks

<b>Sixth Semester</b>	
Major Project Work & Viva	300 marks

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**TOTAL : 3300 marks**  
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A student has to opt for two elective papers in the 5<sup>th</sup> semester as list below.

**Elective courses for Paper CS 5.4**

1. Soft Computing
2. Mobile Computing
3. Parallel Computing
4. Software Project Management

**Elective courses for Paper CS 5.5**

1. Service Oriented Computing
2. Compiler Design
3. Web Engineering
4. Image processing

## **FIRST SEMESTER COURSES**

### **CS 1.1 COMPUTER PROGRAMMING**

#### **UNIT-1**

Program development: Problem Analysis, pseudo code generation, Algorithm, coding, editing, Compiling, executing and testing of programs, Space & time Analysis of Algorithms, Structured programming, Top-down & Bottom-Up Approaches to program development.

C language fundamentals: Character set, Key words, Identifiers, data types, Constants and variables, Statements, Expressions, Operators, Type conversion, Managing input and output

#### **UNIT-2**

Control structures: Decision making, use of conditional statements, IF...ELSE, SWITCH...CASE, looping statements, FOR...., WHILE..., DO...WHILE

Arrays: one dimensional, multidimensional arrays, Declaration and manipulation of arrays

Strings: String variable, String handling functions

#### **UNIT-3**

Functions: Designing structured programs, Functions in C, User defined and standard functions, Formal vs. actual arguments, Function prototype, Parameter passing, Recursive functions.

Storage classes: Auto, Extern, register and static variables.

Pointers, pointer arithmetic, pointers and arrays, Pointer and character strings, Pointers and functions, Array of pointers, pointers to pointers

#### **UNIT-4**

Dynamic memory allocation, malloc( ), calloc ( )

Structure and union: declaration and initialization of structures, Structure as function parameters, Structure pointers, Unions.

File Management: Defining and opening a file, Closing a file, Input/output Operations in files, Pre-processor directives, command line arguments, Macros.

#### **BOOKS:**

1. The C programming Language-Kernigham & Ritchie (PHI)
2. E. **Balguruswamy**, "Programming in ANSI C", McGraw-Hill
3. K.R. Venugopal, S.R. Prasad, "Mastering C, McGraw-Hill Education India

### **CS 1.2 DATA STRUCTURES**

#### **UNIT-1**

Review of algorithmic notations, Linear data structures and their sequential storage representation, representation of stack, Queues, Circular Queues and Dequeues, Operations on these data structures, Applications of Stack and Queue, Priority Queue.

## UNIT-2

Linear data structures and their linked representation: Singly linked, Circularly linked and doubly linked lists, insertion and deletion operations on these data structures, Applications of linked lists: representation of sparse matrix and polynomials.

## UNIT-3

Representation of binary tree, tree traversal algorithms : Inorder, Preorder, Postorder (recursive and non-recursive algorithms), Binary search tree, applications of Binary tree, Representations of graph : adjacency matrix, adjacency list, multi list, graph traversals : Depth first and Breadth first.

## UNIT-4

Searching algorithms: Sequential and Binary search

Sorting algorithms: Insertion, Selection, Bubble, Quick, Merge, Radix and Heap sort.

File structures: Sequential, Indexed sequential and direct access files, Concepts of B-tree and AVL tree.

## BOOKS:

1. Data Structure and Algorithms, G.A. V. Pai, McGraw Hills Education India
2. Fundamentals of Data Structures in C, Horowitz, Sahni, Anderson-Freed, Universities Press India Pvt. Ltd.
3. Data structures, Lipschutz, Mc Graw Hill.
4. Data structure using C/C++, Y. Langsam, A. M. Tenenbaum, PHI.
5. An Introduction to data structures with applications, J. P. Tremblay and P. G. Sorenson, McGraw Hill.

## CS 1.3 LOGICAL ORGANISATION OF COMPUTER SYSTEMS

### UNIT-1

Fetching a Word from memory, Storing a word in memory, register transfer, performing arithmetic and logical operations, execution of complete instruction, hardwired control, CPU-Memory interaction, Multiple Bus Organization.

Logic Gates, D'Morgan's Theorem, Principle of Duality, Boolean Algebra, Sum of product and product of sum Expression, Karnough Map, Universal NAND Gate.

### UNIT-2

Addition and Subtraction in 1's compliment and 2's compliment form, Binary Adder, Subtractor, Parallel Adder, Carry Look Ahead Adder, Multiplication, Booth algorithm, Floating Point Operations (Addition, Subtraction).

Sequential Logic circuit : Flip Flop, S-R FF, D-FF, J-KFF, Master-Slave FF, Shift Registers, Counters (Up, Down, Modulo) serial Adder.

### UNIT-3

CPU Organization : Instruction and instruction sequencing, Instruction formats, Addressing Mode (Direct, Indirect, Immediate, Relative, Indexed, Register Indirect, Auto Increment, Auto Decrement), Basic Input-Output operations, stack and subroutine.

#### **UNIT-4**

Input-Output Organizations : Addressing Input-Output Devices, Interrupts, Handling Multiple Devices, Vector Interrupts, Simultaneous requests, Direct Memory Access (DMA).

#### **BOOKS :**

1. Hamacher : Computer Organization (Mc Graw Hill)
2. Mano M. M.: Computer System Architecture (PHI)

### **CS 1.4 MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE**

#### **UNIT-1**

Statements and Notations, connectives, statement formula and truth tables, normal forms, theory of inference for statement calculus, predicate calculus, inference theory of predicate calculus.

#### **UNIT-2**

Rotations and ordering, functions, recursion, algebraic systems, semi groups and monoids, groups, subgroups, homomorphism, Lagrange's theorem, Normal subgroups, Algebraic systems with two binary operations, application of residue arithmetic to computers, Group codes.

#### **UNIT-3**

Lattice as partial order sets, Boolean Functions, Finite State Machines.

#### **UNIT-4**

Basic concepts of Graph Theory, Directed and Undirected Graph, matrix representation of graph, storage representation and manipulation of graph, trees and their representation and operations, List and graphs.

#### **BOOKS :**

1. Discrete mathematical structures with application to computer science, J. P. Tremblay and R. Manohar (Mc Graw Hill International)
2. Elements of Discrete Mathematics- C. L. Liu (Mc Graw Hill)
3. Modern Applied Algebra- G. Birkhoff and T.C. Bartee (Mc Graw Hill)

### **CS 1.5 TECHNICAL COMMUNICATION**

#### **UNIT - 1**

Nature of technical communication, stages of communication- encoding, transmission, decoding, response, Channels of communication: upward, downward, Horizontal and grapevine

Aspects of technical communication, forms of technical communication, technical communication skill: listening, speaking, reading and writing.

Barriers to effective communication; improper encoding, bypassing, frame of reference, physical distraction, psychological and emotional interference, intercultural difference

### **UNIT – 2**

Organization in technical communication: introduction, spatial organization, chronological organization, general to specific organization, specific to general organization, order of increasing importance, order of decreasing importance, emphatic organization.

Style in technical communication: technical style, accuracy, using exact words and phrases, brevity, clarity. Objectivity in technical writing, impersonal language, objectivity in professional speaking, formal language.

### **UNIT – 3**

Listening: The listening process, types of listening: superficial, appreciative, focused, evaluative, attentive, empathetic, listening with a purpose, barrier to listening: physical, psychological, linguistic, cultural, improving listening, comprehension.

Speaking: The speech process, conversation and oral skills, strategies for good conversation, improving fluency and self expression- body language, phonetics and spoken language, speaking techniques, professional speaking, job interviews, group discussion, presentation skills.

Reading: The reading process, reading strategies, comprehension of technical material.

Writing strategies, effective writing, note making, summarizing, e-mail messages, reports, proposals, technical articles.

### **UNIT – 4**

Personality development and soft skills: personality theories: Carl Rogers, Maslow, Eysenck, Murray, emotional Intelligence, lateral thinking

Soft skills: becoming a good leader and team-player, inter-relating soft skills and communication skills

### **BOOKS:**

1. Effective Technical Communication, M. Ashraf Rizvi (TMH)
2. Communication Skills: Mathew McKay, Martha Davis, Patrick, B. Jain publications
3. Business Communication, Meenakshi Raman and Prakash Singh, Oxford pub.
4. Business Communication Today, Bovee et al, Pearson pub.

### **CS 1.6 Practical - 1 (C Programming & UNIX/LINUX)**

## **SECOND SEMESTER COURSES**

### **CS 2.1 DATA BASE MANAGEMENT SYSTEMS**

#### **UNIT-1**

Introduction to Database Systems, DBMS concepts and architecture, Data models, schemas and instances, Data Abstraction, Data Independence, Database languages. Role of DBA  
Data modelling using Entity - Relationship (ER) Model: Entity sets, attributes and keys, Relationship types, sets, roles and structural constraints, Weak Entity types. Data Models: Relational, Network, Hierarchical and Object Oriented.

#### **UNIT-2**

Relational model: Codd rules, Relational model constraints, Relational Algebra and Relational calculus, Constraints on Relations, Relational database design by ER & EER to Relational Mapping.  
SQL, set operations, nested subqueries, derived relations, views and indexes, triggers.  
Database Design: Data dependency, Functional dependencies, Normalization, First, Second and Third Normal forms, Boyce-Codd Normal form (BCNF)

#### **UNIT-3**

Query Processing: Evaluation of Relational Algebra Expressions, Query Equivalence, Join strategies, Query Execution  
Storage Strategies and file organizations: Disc Storage, Basic File Structures and Hashing, Indexing structures for files, multi-level indexing using B-trees and B<sup>+</sup>-trees.

#### **UNIT-4**

Transaction processing in data bases: states of a transaction, ACID Properties, Serializability.  
Concurrency control: lock-based and timestamp based protocols  
Database recovery techniques: log-based recovery and shadow paging, Database Security.  
Deadlock detection and recovery.

#### **BOOKS :**

1. Database Systems Concepts, A. Silberschatz, H. F. Korth, S. Sudarshan (McGraw Hill)
2. Fundamentals of Database Systems, Elmsari and Navathe (Addison Wesley)
3. An Introduction to Database Systems, C. J. Date, (Addison Wesley)

### **CS 2.2 OPERATING SYSTEM**

#### **UNIT-1**

Evolution of Operating Systems, Batch processing, Multiprogramming, time sharing, real-time systems, multi-tasking, multi processor systems, Operating System Structure, Operating system services.  
File systems, File access methods: sequential, indexed and direct, File Allocation Methods, directory systems, File protection mechanisms.

### **UNIT-2**

CPU Scheduling, Scheduling concepts, Scheduling techniques: preemptive and non-preemptive, FCFS, SJF, Priority, Round Robin, multi-level feedback queues, evaluation of scheduling techniques.

Memory management: Contiguous and non-contiguous allocation, MFT, MVT, memory fragmentation, swapping, paging and segmentation.

### **UNIT-3**

Concept of Virtual Memory, demand paging, page faults, page replacement techniques: FIFO, Optimal, LRU, Belady's Anomaly, frame allocation techniques, Thrashing.

Disk scheduling : FCFS, SSTF, Scan, Look, C-Scan, C-Look

### **UNIT-4**

Concept of Deadlock, conditions for deadlock, resource allocation graph, deadlock prevention, deadlock avoidance, safety sequence, Banker's algorithm, deadlock detection and recovery, Inter-process Communication (IPC), Concurrent processes, Process synchronization, Critical Section, Classic IPC Problems, Mutual Exclusion, Semaphore.

### **BOOKS :**

1. Operating system concepts, Galvin and Silberschatz, Wiley India Pvt. Ltd., New Delhi.
2. Modern Operating systems, A.S. Tanenbaum, Pearson Education Inc., New Delhi.
3. Operating Systems: A Spiral Approach", Elmasri, Carrick, Levine, McGraw-Hill

## **CS 2.3 COMPUTER ARCHITECTURE**

### **UNIT - 1**

Register Transfer Language, Arithmetic, Logical and Shift Micro Operation, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory Reference Instructions, Input-Output and Interrupt. Design of Basic Computer, Design of Accumulator Logic.

### **UNIT - 2**

Micro-Programmed Control : Control Memory, Address Sequencing, Micro Program, Design of Control Unit, Bit Slice Processor.

### **UNIT - 3**

Memory Hierarchy, Main Memory, Associative Memory, Cache Memory, Cache Memory Mapping, Virtual Memory, Interleaved Memory.

### **UNIT - 4**

Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Multifunction Pipeline, Vector Processing, Attached Array Processor, SIMD Processor.



**BOOKS :**

1. Computer Architecture and Organization- J. P. Hyes (Mc Graw Hill)
2. Computer system Architecture- M. M . Mano (PHI)

**CS 2.4 COMPUTER ORIENTED NUMERICAL AND STATISTICAL TECHNIQUES****UNIT-1**

Solution of Algebraic and Transcendental equations, Bisection method, Method of false position, Newton-Raphson method, Algorithm and convergence of the above methods and error analysis.

**UNIT-2**

Solution of simultaneous linear equations : Gauss elimination method, Gauss-Jordan method, Gauss-Seidal method, Gauss-Jacobi method, error analysis of the above methods, ill-condition equation and refinement.

**UNIT-3**

Interpolation, polynomial interpolation, Lagrange Interpolation, Different Table, Error detection, Newton's forward and backward, Simpson's 1/3 rule.

**UNIT-4**

Probability theory : sample space, Events, probability of events, probability of union, intersection and complement of events, conditional probability, Baye's theorem, normal, binomial, poisson distribution.

**BOOKS :**

1. Computer oriented Numerical Methods, V. Rajaraman (PHI)
2. Computer based numerical algorithms, V. Krishnmurthy and S. K. Sen (East-West).
3. Probability & Mathematical Statistics, B. D. Gupta & O. P. Gupta (Sultan Chand)

**CS 2.5 MANAGEMENT INFORMATION SYSTEM****UNIT - 1**

Importance of information systems, Framework for business End users, Global information society, Need for information technology in Business, Globalization, Business process re-engineering, Information, System concepts, feedback & controls, Info. System components resources & activities, Types of Info system Operations support systems, management support system.

**UNIT-2**

System approach to problem solving, defining problems & opportunities, developing & evaluating alternative solutions, System development cycle: feasibility study, system analysis, system design, prototyping, computer aided systems engineering.

### UNIT-3

Business information systems: marketing information system, manufacturing information system, accounting information system, human resource information system, financial information system, Transaction Processing system, information system for management, decision support system (DSS & EIS).

### UNIT-4

Information system for strategic advantage, reengineering business process, Managing information resources & technologies: operational management, resource management, technology management, distributed management, organizational planning & information technology, implementing business changes, security & ethical issues in information systems.

### BOOKS :

1. Management Information System (4<sup>th</sup> Edition), James A O'Brien (Galgotia)
2. Management information system, Sadagopan (PHI)

### **CS 2.6 Practical – 2 (Data Base)**

## **THIRD SEMESTER COURSES**

### **CS 3.1 OBJECT ORIENTED PROGRAMMING WITH C++**

#### UNIT – 1

Object oriented features in C++, data-types, variables and operators, Control Structures, Decision and Loop Control Statements, functions, structures and unions in C++, Coding Style in C++  
Object Oriented Programming in C++: Abstraction: Procedural Abstraction and data abstraction;  
Classes and objects, object creation, access specifier : private, public and protected, constructors, default constructors, copy constructors, destructors, member functions, static members

#### UNIT – 2

Inheritance: simple inheritance—Class hierarchy, derived classes, Multiple inheritance, multileveled and hybrid inheritance, Abstract Base Classes, Composition and aggregation with example, polymorphism—compile time & run time polymorphisms, virtual functions and Dynamic Binding.

#### UNIT – 3

Overloading: Function overloading and Operator overloading, ambiguity, Overloading Restriction, friends function, member operators, I/O operators, Automatic Conversions and Type Casts for Classes

Memory management in C++: new, delete, object copying, *this* pointer.

## UNIT – 4

Exception Handling: Exceptions and exception class, exception declarations, unexpected exceptions, Returning an Error Code, Exception Mechanism, Using Objects as Exceptions  
Templates and Standard Template Library: Generic Programming in C++, Template classes, Template functions,  
Files in C++: iostream, I/O streams classes, File Input and Output, Command-Line Processing.

### BOOKS:

1. Object-Oriented Programming with C++, E. Balguruswamy, TMH, New Delhi.
2. Object-Oriented Programming with C++, David Parsons, Pearson Education .
3. C++ Primer plus, Stephen Prata, Pearson Education

## CS 3.2 ANALYSIS AND DESIGN OF ALGORITHMS

### UNIT-1

Review of basic data structures, concepts in algorithm analysis, asymptotic complexity, Big O, Omega and Theta notations.

### UNIT-2

Domain independent algorithm, design techniques such as divide and conquer, Greedy technique, Dynamic programming, Back tracking, Branch and Bound techniques.

### UNIT-3

Example algorithm for the above techniques from sets, graphs, text processing, internal and external sorting, height balanced trees, B-trees, hashing algorithms, Dynamic storage allocation.

### UNIT-4

Lower bound theory, NP hard problem.

### BOOKS :

1. Fundamentals of Computer Algorithms– Horowitz, Sahni, Rajasekaran, Universities Press India Pvt. Ltd.
2. The design and analysis of computer algorithms–Aho, Ulman (Addison Wesley).
3. Data Structures and algorithm– Aho and Ulman (Addison Welsey).
4. Introduction to algorithms–Coremen, Leisorsen and Rivest (PHI)

## CS 3.3 COMPUTER NETWORK

### UNIT-1

Introduction to computer networks, uses of computer networks, Network Hardware, Network software, OSI Reference Models, Wireless Transmission, Cellular Radio, Satellite Network , Data link layer design issues, Error Detection and Correction, Elementary Data link Protocols, Protocol Specification and Verification.

### UNIT-2

Channel Allocation Problem, Multiple Access Protocols, IEEE standard 802 for LANS and MANS, Internetworking Devices : Repeater, Bridges, Router, Gateway, High-speed LANS, Satellite Networks, Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, TCP/IP Protocol Suit, ATM networks.

### UNIT-3

Transport Layer Services, Elements of Transport Protocols, Performance Issues, Cryptography and Network security.

### UNIT-4

DNS, Electronic mail, SMTP, FTP, TELNET, SNMP, WWW and HTTP.

### BOOKS :

1. Computer Networks -A S Tenenbaum (PHI)
2. Data communications and Networking - B. A. Forouzan (PHI)

## CS 3.4 COMPUTER BASED OPTIMISATION TECHNIQUES

### UNIT- 1

Linear programming problem, graphical solution, simplex method, artificial variable technique, solution of simultaneous linear equations and matrix inversion using simplex method, duality in linear programming.

### UNIT-2

Dual simplex method, revised simplex method, sensitivity analysis, Integer programming, goal programming.

### UNIT- 3

Assignment problem, travelling salesman problem, transportation problem, job sequencing, non-linear programming.

### UNIT-4

Quadratic programming, time estimates and critical path in network analysis, project management by PERT/CPM method, resource leveling and smoothing.

### BOOKS:

1. Operation research-S.D. Sharma (Kedar Nath Ramnath Publication)
2. Introduction to operation Research: A computer oriented Algorithm approach - B.E. Gillett (Mc Graw Hill).
3. Operations Research - Kanti Swarup (Sultan Chand & sons).
4. Optimization Theory - S.S. Rao.
5. Problems and solutions in Operation - V.K.Kapoor

## **CS 3.5 SOFTWARE ENGINEERING**

### **UNIT – 1**

Evolution of Software Engineering, Software Processes, software Life cycle Models, Software Project Management.

Software Requirements, Requirements Engineering, Feasibility study, Requirements analysis and specification, System Models, Critical System Specification, Formal Specification.

### **UNIT – 2**

Software Design, Architectural Design – Cohesion and coupling, Abstraction, Data flow Oriented Design, Object-Oriented Design, User Interface Design.

Software Development: Rapid Software Development, Software Reuse: Design Patterns, Component Based Software Engineering (CBSE).

Implementation and Testing: Verification and Validation, Software Testing techniques

### **UNIT – 3**

Software Cost Estimation, COCOMO Model, Software Reliability, Software Quality Management, Process Improvement, Configuration Management, Software Maintenance.

### **UNIT – 4**

New trends and technologies in software development, Capability Maturity Model, Capability Maturity Model Integration, Agile software development, Extreme Programming, Service-oriented Software Engineering

### **BOOKS:**

1. Fundamentals of Software Engineering - Rajib Mall (PHI)
2. Software Engineering - Ian Sommerville (Pearson Education)
3. Software Engineering: A Practitioner's Approach - Roger Pressman (McGraw Hill)

## **CS 3.6 Practical – 3 (C++ Programming)**

## **FOURTH SEMESTER COURSES**

### **CS 4.1 PROGRAMMING IN JAVA**

#### **UNIT – 1**

Introduction to Java Programming, concept of JVM, Data Types and Operations, Structured Programming, Selection Statements, Loops, Methods, Method Abstraction and Stepwise Refinement, Arrays

Classes and Objects, Constructors, Implementing & Designing Classes, Use of Keywords: *static*, *final*, *this*, Class Abstraction and Encapsulation, Strings and Text I/O

## UNIT – 2

Inheritance, use of *super* keyword, Overriding vs. Overloading  
Abstract Classes and Interfaces, Packages, polymorphism, Object-Oriented Design and Patterns.

## UNIT – 3

GUI Programming: GUI Basics, Graphics, Event-Driven Programming, Creating User Interfaces, Applets and Multimedia, Exception Handling, Binary I/O, Files & Streams, Recursion, Dynamic Binding, Generic Programming.

## UNIT – 4

Multithreading, JDBC, MVC, JavaBeans, Containers, Swing Models, *JTable* and *JTree*, advanced features of Java.

### BOOKS:

1. Introduction to Java Programming: Comprehensive Version- Y. Daniel Liang, Pearson Education Inc., New Delhi.
2. Programming with Java: A Prime - E. Balagurusamy, McGraw-Hill Education (India).
3. Java How to Program -Harvey M. Deitel & Paul J. Deitel, PHI, New Delhi.

## CS 4.2 OBJECT ORIENTED MODELING

### UNIT – 1

Introduction: Object orientation & Object oriented development, Modeling Concepts: Modeling as a design technique, Class Modeling, advanced class modeling, State Modeling, advanced State Modeling, Interaction Modeling, advanced Interaction Modeling.

### UNIT – 2

Analysis and Design: Process overview, system Conception, Domain Analysis, System Design, Class design.

### UNIT – 3

Implementation: Implementation Modeling, Object Oriented (OO) Languages, Databases, Programming Style.

### UNIT – 4

UML diagrams: Use case diagram, interaction diagram, activity diagram, state chart diagram, component diagram and deployment diagram

### BOOKS:

1. *Object-Oriented Modeling and Design with UML*, Michael R. Blaha and James R Rambaugh, Pearson Education, Inc. New Delhi.
2. *Practical Object-Oriented Design with UML*, Mark Priestley McGraw-Hill Education, India.

3. *Object-Oriented Analysis and Design with Applications*, Grady Booch, Pearson Education, Inc. New Delhi.
4. *The Unified Modeling Language Reference Manual*, James Rumbaugh, Grady Booch, Ivar Jacobson, Pearson Education, Inc. New Delhi.

### **CS 4.3 INFORMATION SECURITY**

#### **UNIT – 1**

Attacks, services and mechanism, security attacks, security services, conventional encryption model, Steganography, cipher principles, data encryption standards, strength of DES, differential and linear crypto analysis, Block cipher design principles, Block cipher model of operation.

#### **UNIT – 2**

Triple DES, international data encryption algorithm, blowfish, RC5, CAST-128, RC2, characterization of advanced symmetric block ciphers, placement of encryption function, traffic confidentiality, key distribution, random number generation, public key cryptography : principles of public key cryptosystem, RSA algorithm, Key management, diffie-Hellman key exchange, Elliptic curve cryptography.

#### **UNIT – 3**

Message authentication and Hash function : authentication requirements, functions message authentication codes, hash functions, security of hash functions and MACs, MD5 message digest algorithm, secured hash algorithm, digital signatures, authentication protocols, digital signature standard.

#### **UNIT – 4**

Firewall design principles, IP security architecture, authentication header, encapsulating security payload, security associations, key management.

#### **BOOKS:**

1. Cryptography and network security Principles and practice - William Stallings (Person education)
2. Applied Cryptography–Schneier (John wiley)
3. Cryptography and network–Security Atul Kahate (TMH)

### **CS 4.4 DISTRIBUTED SYSTEMS**

#### **UNIT – 1**

Introduction to Distributed systems, types of Distributed Systems, Architectures, Key characteristics-resource sharing openness, concurrency, scalability, fault tolerance, transparency; Design issues, naming, communication, workload allocation, consistency maintenance; Interprocess communication, client server communication, RMI.

### **UNIT – 2**

Distributed Operating systems: kernel, processes and threads, Naming and protection - Communication and Invocation, virtual memory, Distributed file services - design issues, interfaces, implementation techniques, Name services: Name spaces; Name resolution, Domain Name System, Peer-to-Peer Systems. Coordination and Agreement: Time and Global States, Time and co-ordination, Synchronizing physical clocks- logical time and logical clocks, Distributed co-ordination, distributed mutual exclusion, elections.

### **UNIT – 3**

Distributed database systems: a comparative view of distributed DB and centralized DB, distributed DBMS, levels of distribution transparency, reference architecture, data fragmentation (hierarchical, vertical and mixed), Distributed database design: top-down and bottom up approaches, Management of distributed transactions, concurrency control, distributed deadlocks.

### **UNIT – 4**

Recovery and fault tolerance in distributed systems: Transaction recovery, Fault tolerance, Hierarchical and group masking of faults; Security, authentication and key distribution, CORBA, Distributed object based systems, Distributed file systems.

### **BOOKS:**

1. Distributed Systems: Concepts and Design - George Coulouris, Jean Dollimore et al Pearson Education, Inc. New Delhi.
2. Distributed Systems: Principles and Paradigms - Andrew S. Tanenbaum, Maarten van (PHI)
3. Principles of Distributed Database Systems – M. Temer Ozsu, P.Valduriez (Pearson Educations)

## **CS 4.5 COMPUTER GRAPHICS**

### **UNIT – 1**

Display Devices, Display Processors : Simple Refresh Line Drawing Display, Random-Scan Storage Tube Display, High Performance Display, Device Independence, Graphics System Design, Function Set Design.

Coordinate Systems, Incremental Methods, Line Drawing Algorithms, Circle Generators, Transformation Principles.

### **UNIT – 2**

Clipping and Windowing : Line Clipping Algorithm, Mid-Point Subdivision, Polygon Clipping, Viewing Transformations, Windowing Transformations.

Graphical Input Devices, Pointing and Positioning Devices, Mouse, Tablets, Light Pen. Graphical Input Techniques : Positioning, Pointing, Selection, Inking and Painting.

### **UNIT – 3**

Raster Graphics Fundamentals : Generating and Representing Raster Images, Scan Converting, Line Drawings, Displaying Characters.



3D Transformations: Transformations Modeling and Viewing, Perspective Transformation, 3D Clipping, Screen Coordinate System and its properties.

#### **UNIT – 4**

Hidden Surface Elimination: Depth Buffer Algorithm, Geometric Computation, Scan-Line Coherence Algorithm, Area Coherence Algorithm.

Shading: Shading Model, Applying the Shading Model, Special Effects.

#### **BOOKS:**

1. Principles of Interactive Computer Graphics – W.M. Newman, R F Sproull (McGraw Hill)
2. Computer Graphics - Zhigang Xiang, Roy A. Plastock (McGraw-Hill Education, India)

#### **CS 4.6 Practical – 4 (Java Programming)**

### **FIFTH SEMESTER COURSES**

#### **CS 5.1 E-COMMERCE**

##### **UNIT – 1**

Introduction to e-commerce: Business models and business processes, identifying e-commerce opportunities, international nature of e-commerce, technology infrastructure-internet & WWW; Business strategies for e-commerce: Revenue models in transaction, revenue strategic issues, creating an effective web presence, website usability; Marketing on the web: Web marketing strategies, communicating with different market segments, customer behavior and relationship intensity, advertising on the web, technology enabled CRM

##### **UNIT – 2**

Business to business strategies: Purchasing, logistics and supply activities, electronic data interchange (EDI), electronic data interchange on the internet, supply chain management using internet technologies, electronic market place & portals (Home shopping, E-marketing, Tele marketing), auctions, online auctions, virtual communicative & web portals.

##### **UNIT – 3**

Payment systems in e-commerce: card system, E-check, E-cash, use of digital signature  
Technologies for e-commerce: web server hardware & software, e-commerce software  
Intelligent agents in E-commerce, PUSH & PULL technology

##### **UNIT – 4**

Security issues in e-commerce, online security issues, security for client computers and server computers, communication channel security

Legal, ethical & tax issues in e-commerce, intellectual property in online business, online crime, terrorism & warfare, ethical issues.

Planning for e-commerce: planning e-commerce initiatives, strategies for delivering e-commerce web sites, managing e-commerce Implementations.

**BOOKS :**

1. E-Business and E-Commerce Management- Dave Chaffey (Pearson Education Inc)
2. Electronic Commerce - Gary P. Schneider (CENGAGE Learning India)
3. E-Commerce- K.K. Bajaj, D. Nag (McGraw Hill Education)
4. Electronic Commerce-Technology and Application - Bhaskar Bharat, (McGraw Hill)
5. E-Commerce fundamentals and Applications – Chan (Wiley India)

**CS 5.2 ARTIFICIAL INTELLIGENCE**

**UNIT – 1**

Concepts in AI, problem solving in AI, Defining an AI Problem as state space search, production systems, AI problem characteristics.

Heuristic Search Techniques : generate-and-test, hill climbing, best first search, problem reduction, simulated annealing.

**UNIT – 2**

Knowledge Representation in AI, approaches & issues in knowledge representation, Knowledge Representation using predicate logic, forward and backward reasoning, semantic nets, frames, scripts & conceptual Dependency.

**UNIT – 3**

Expert systems: Architecture, knowledge base, inference engine, Knowledge acquisition Expert system development.

Natural language processing: Syntactic processing, Semantic analysis.

**UNIT – 4**

Introduction to pattern recognition and classification process, learning classification patterns, Visual image understanding, image transformation, Parallel and distributed AI.

Artificial Neural networks, LMS learning rule, General Delta Rule, Back Propagation.

**BOOKS:**

1. Artificial Intelligence - E. A. Rich and Kelvin Knight (TMH)
2. Introduction to AI and Expert Systems- D.W.Patterson (PHI)
3. Principles of AI and Expert systems development, D. W. Rolston (McGraw Hill)
4. Artificial Intelligence- P . H. Winston (Addison Wesley)

**CS 5.3 DATA MINING**

**UNIT -1**

Introduction to data mining, knowledge discovery, DBMS vs. data mining, issues and challenges in data mining , application areas.

Concept of Data warehousing, 3-tier architecture, multidimensional data model, OLAP, ROLAP, and MOLAP operations.

### **UNIT-2**

Concept hierarchies, interestingness measures, data generalization and summarization-based characterization, Mining association rules, Apriori algorithm for finding frequent itemsets, iceberg queries, mining multilevel association rules, mining distance-based association rules, correlation analysis.

### **UNIT-3**

Classification and prediction: decision tree based classification, Bayesian classification, classification by back propagation, k-nearest neighbor classifier  
Cluster analysis: categorization of clustering methods, partitioning methods, k-Means and k-Medoids, hierarchical methods, Density-based clustering (DBSCAN)

### **UNIT-4**

Web Mining, classification of web documents, web content mining, web structure mining, web usage mining, text mining, text clustering, Mining spatial databases, mining multimedia databases, Temporal data mining, temporal association rules, sequence mining.

### **BOOKS:**

1. Data mining; Concepts and techniques by J. Han and M. Kamber (Morgan Kaufmann)
2. Data Mining by A.K. Pujari (University press)

## **ELECTIVE COURSES FOR PAPER: CS 5.4**

### **SOFT COMPUTING**

#### **UNIT - 1**

Introduction to soft computing, fundamentals of fuzzy logic systems: Introduction, background, fuzzy sets, generalized fuzzy operations, implication, fuzziness and fuzzy resolution, fuzzy relations, composition and inference, fuzzy decision making.

#### **UNIT - 2**

Fundamentals of artificial neural networks: introduction, learning and acquisition of knowledge, features of artificial neural networks, fundamentals of connectionist modeling. Classes of neural networks: introduction, multilayer perceptron, radial basis function networks, Kohonen's self-organizing network, Hopfield network, industrial and commercial applications of ANN.

#### **UNIT - 3**

Neuro-fuzzy systems: introduction, background, architectures of neuro-fuzzy systems, construction of Neuro-fuzzy systems. Overview of Evolutionary computing

#### **UNIT - 4**

Genetic algorithms and optimization, the schema theorem, genetic algorithm operators, integration of genetic algorithms with neural networks, integration of genetic algorithms with fuzzy logic, known issues in GAs, population-based incremental learning, evolutionary strategies

#### **BOOKS:**

1. Soft Computing and Intelligent Systems Design: Theory, Tools and Applications - Fakhreddine O. Karray, Clarence De Silva (Pearson Education, New Delhi)
2. Principles of Soft Computing - S. N. Sivanadam, S. N. Deepa (Wiley India Pvt. Ltd)
3. Soft Computing - D. K. Prathihar (Narosa Publication)
4. Soft Computing - A. K. Srivastava (Morgan & Claypool / Narosa, New Delhi)
5. Soft Computing and Intelligent Systems: Theory and Applications - N. K. Sinha, (Elsevier India Pvt. Ltd)

### **MOBILE COMPUTING**

#### **UNIT -1**

Introduction to mobile computing, issues and applications, mobile computing architecture, mobile system networks, data dissemination, mobility management, mobile devices & systems, limitation of mobile devices

#### **UNIT-2**

GSM services, GSM system architecture, signaling protocols, localization, communication calling and handover, GPRS architecture and protocol layers  
Mobile IP, working of mobile IP, packet delivery and handover management, location management, registration, tunneling, route optimization

#### **UNIT-3**

Mobile databases, database hoarding, data caching, data & web cache maintenance in mobile environments, client-server computing and adaptation, power-aware computing, context-aware computing, transactional models, query processing, data recovery  
Data dissemination & broadcasting systems: push & pull based mechanisms, broadcast models, indexing techniques, Data synchronization in mobile computing systems

#### **UNIT-4**

Mobile Ad-hoc & sensor networks, MANET and its applications, Routing algorithms: DSR protocol, AODV routing protocol, and TORA.  
Wireless sensor networks, applications, WLAN architecture, introductory concepts of mobile application languages: XML, J2ME, features of Mobile OS: Palm OS, Symbian OS

#### **BOOKS :**

1. Mobile Computing, Raj Kamal (Oxford University press)

2. Mobile Computing Technology, Applications & Service Creation, A K Talukder & R R Yavagal (TMH)

## **PARLLELEL COMPUTING**

### **UNIT-1**

Models of parallel computation : Processor organizations (Mesh, Pyramid, Butterfly, Hypercube), SIMD models, Associative processor , Multi-Processors (Loosely coupled and tightly coupled ), Multi –computers , Amdahl’s Law , Developing algorithms for processor array and MIMD computers, Process communication and synchronization on MIMD models, Deadlock , Task scheduling on MIMD computers.

### **UNIT-2**

Sorting on Processor Arrays, Multiprocessor implementation of Quick sort , complexity of parallel search , Searching on tightly coupled multiprocessor (Ellis’s and Manbar and Ladne’s Algorithm), Matrix Multiplication for processor array and multiprocessors .

### **UNIT-3**

Graphs and Combinatorial Search

Processor Arrays : Searching , Connected components , All pairs shortest path : multiprocessor Minimum spanning tree ,Single source shortest path .

Combinatorial Search : Divide and conquer , Branch and bound , Travelling sales man problem Alpha –Beta search and parallel Alpha- Beta search and parallel Alpha- Beta search.

### **UNIT-4**

Piplined and Vector Processors

Vector computers , pipelined vector processor , CRAY-1 ,CRAY- XMP and CYBER 205 computers , Vectorizing compilers , Attached Processors (FPS 164 MAX)

### **BOOKS :**

1. Designing Efficient Algorithm for parallel computers – M J Quinn (Mc Graw Hill)
2. Computer Architecture and parallel processing - Hwang , Briggs (Mc Graw Hill)

## **SOFTWARE PROJECT MANAGEMENT**

### **UNIT-1**

Conventional software project management, principles of modern software management.

software cost estimation, Reducing software product size, improving software processes, improving team effectiveness, improving automation through software environments, achieving required quality.

Life-cycle phases: Engineering and production stages, inception phase, elaboration phase, construction phase transition phase.

### **UNIT-2**

Model-based software architectures and Process Architecture: management perspective, technical perspective. Workflows of the process: Software process workflows, Iteration workflows. Checkpoints of the process: Major milestones, minor milestones, periodic status assessments.

Iterative process planning: Work breakdown structures, planning guidelines, the cost and schedule estimating process, the iteration planning process.

### **UNIT-3**

Process automation and Project control: Automation building blocks, the project environment, Project control and process instrumentation: The seven core metrics, management indicators, quality indicators, life-cycle expectations, pragmatic software metrics, metric automation, small-scale project versus large-scale project.

### **UNIT-4**

Modern project profiles: Continuous integration, early risk resolution, evolutionary requirements, teamwork among stakeholders, software management best practices, Next-generation software economics and Modern process transitions: Next-generation cost models, modern software economics.

### **BOOK:**

Software Project Management - Barry Boehm (Pearson Education Asia)

## **ELECTIVE COURSES FOR PAPER: CS 5.5**

### **SERVICE ORIENTED COMPUTING**

#### **UNIT-1**

Service oriented computing paradigm: computing with services, its suitability for the evolving open environment, a comparative view of objects, components and services, Service-oriented architecture: service provider, service consumer, service registry, SOA collaboration, service orchestration and service choreography.

#### **UNIT-2**

Coordination frameworks for web services: WSCL, Web services choreography interface, WS-coordination: coordination service, activation service, registration service, Service management, Notion of grid services

#### **UNIT-3**

Building SOC applications: elements of SOC design, steps of the SOC approach, service identification, domain decomposition, subsystem analysis, service allocation, component specification, technology realization mapping. Applications of SOC.

#### UNIT-4

Web services architecture, Web services standards, web services technology options: Transport (HTTP, Java Message service), Service Communication protocol (SOAP), Service Description (XML, WSDL), accessing web services, Service registry (UDDI), security issues.

#### BOOKS:

1. Service-Oriented Computing - M.P. Singh & M . N. Huhns (John Wiley & Sons Ltd)
2. Patterns: Service-Oriented Architecture & Web Services, IBM Redbook.

### COMPLIER DESIGN

#### UNIT-1

Introduction to compliers, compliers and Interpreters, Phases of Compiler : Lexical analysis, syntax analysis, Intermediate code generation, code optimization, object code generation, symbol table management, error handling, multi-pass compliers, cross compiler.

Lexical analysis : role of lexical analyzer, design of lexical analyzer, finite state machine, transition diagram, regular expression, conversion of NDFSM to DFSM, regular expression to FSM.

#### UNIT-2

Syntax Analysis : syntactic specification of programming language, context free grammar, derivation of parser tree, basic parsing techniques, types of parser, shift-reduce parser, operator, grammar, operator precedence grammar, operator precedence parsing, LL(I) grammar, predictive parser.

#### UNIT-3

Intermediate code generation : syntax directed translation schemes, implementation of SDTS, intermediate codes : polish notation. Abstract syntax tree, three address codes, quadruples, triples, indirect triples translation of assignment statement, Boolean expression, declarative statement.

Symbol table and error handling : data structure of symbol table, types of errors, lexical and semantic errors.

#### UNIT-4

Code optimization : Sources of code optimization, loop optimization, identification of loops, DAG representation.

Object code generation : problem of code generation, simple code generation, register allocation and object code generation, peep hole optimization.

#### BOOKS :

1. Principles of compiler Design - Aho & Ullman (Narosa)
2. Compiler design : Theory and practice - Burrett (Mc Graw Hill)

## **WEB ENGINEERING**

### **UNIT-1**

Web-based Systems, Web Engineering, Web Engineering Process, Communication, Planning.

### **UNIT-2**

Modeling Activity, Analysis Modeling for Web Applications, Web Application Design, Interaction Design, and Information Design.

### **UNIT-3**

Functional Design, Construction and Deployment, Design Patterns, Technologies and Tools, Web Applications Testing, Change and Content Management, Future Directions.

### **UNIT-4**

Web application development for student admission, online shopping, hotel booking, internet banking.

### **BOOKS:**

1. Web Engineering: A Practitioner's Approach - Roger S Pressman, David Lowe, (McGraw Hill Education, India)
2. Web Engineering - Emilia Mendes, Nile Mosley (Springer India Pvt. Ltd.)

## **IMAGE PROCESSING**

### **UNIT-1**

Introduction to digital image processing, Digital image representation, steps in image processing, elements of Digital Image Processing System. Elements of Visual perception, Sampling and Quantization, Basic relationships between Pixels.

### **UNIT-2**

Image Transforms, Imaging geometry, Photographic film, Fourier transform, properties of two separable Fourier transform, Four Fourier transform, other separable Fourier transforms.

### **UNIT-3**

Image Enhancement, background of image enhancement, enhancement by point processing, spatial filtering, enhancement in the frequency domain, colour image processing.

### **UNIT-4**

Image Restoration : Degradation model, diagonalization of circulant block, circulant matrices, algebraic approach to restoration, inverse filtering, least mean square restoration, interactive restoration, restoration in the spatial domain, geometric transformations.

### **BOOKS:**

1. Digital Image processing - R.C. Gonzalez and R.E. Wood (Addition Wesley)
2. Fundamentals of Digital Image Processing - Anil K. Jain (PHI)

**CS 5.6 Minor Project & Comprehensive Viva**